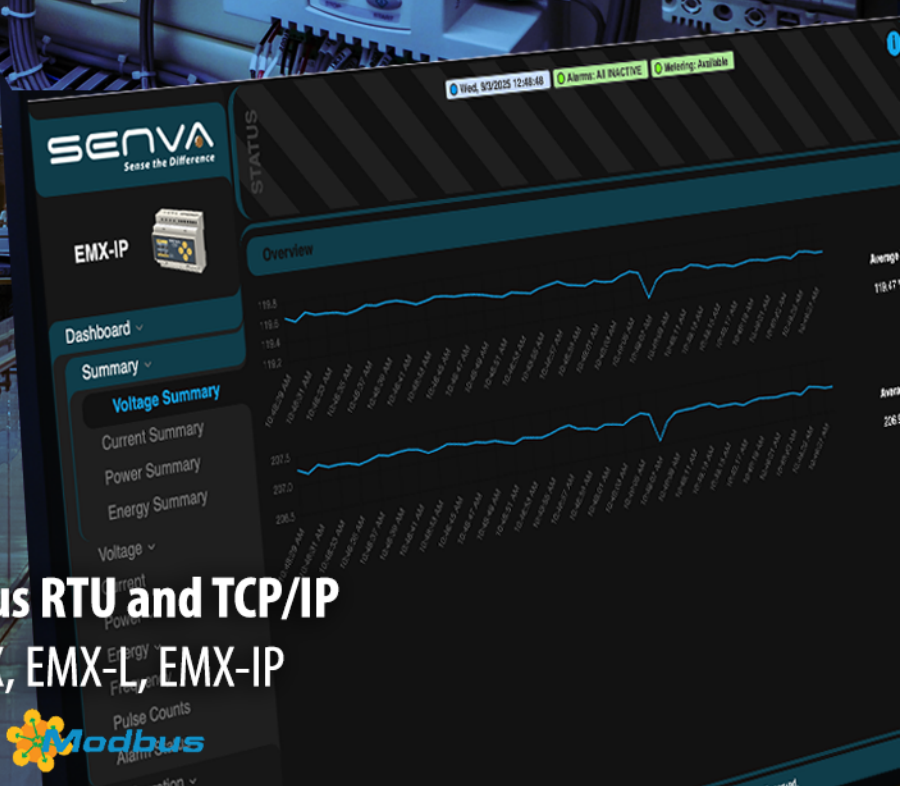


EMX Modbus Guide



Modbus RTU and TCP/IP
EMX, EMX-L, EMX-IP



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Congratulations on installing your new Senva EMX energy meter! This Modbus Protocol Guide assumes the first stage of installation is complete, with the meter and any CTs connected and powered. If using the EMX or EMX-IP the OLED display should show the home screen when any button is pressed. If not, refer to the separate Installation Instructions before continuing. For EMX-L, the SenvaSync app, available on both Android and iOS, is used instead of the display. Now, only the network configuration remains between you and the data.

Modbus

Data Types

Natively, Modbus holding register functions only support the UINT16 type (2 bytes). The meter constructs additional types from two or more consecutive registers. Client interface software must support the same construction for proper communication:

Data Type	Description	# of Reg.	Range (hexadecimal)
BOOL	binary value	1	0 to 1
ENUM (UINT16)	16-bit unsigned integer that maps to a defined list of values	1	0 to specified upper limit
U8 (UINT8)	8-bit unsigned integer	1	0 to 255 (0x00FF), unless otherwise noted
U16 (UINT16)	16-bit unsigned integer	1	0 to 65535 (0xFFFF), unless otherwise noted
I16 (INT16)	16-bit integer	1	-32768 to -32767 (0xFFFF), unless otherwise noted
U32 (UINT32)	32-bit unsigned integer	2	0 to 4294967295 (0xFFFFFFFF), unless otherwise noted
U64 (UINT64)	64-bit unsigned integer	4	0 to 18.446e+18 (0xFFFFFFFFFFFFFFFF), unless otherwise noted
I64 (INT64)	64-bit signed integer	4	-9.233e+18 to 9.233e+18 (0xFFFFFFFFFFFFFFFF), unless otherwise noted

UINT32, UINT64, and INT64 data always occupies two or four registers (4 and 8 bytes) in network byte order (MSB first). Read and write operations should address both registers.

R/W

- **R:** Readable Only
- **R/W:** Read and writeable

Scale

Values must be multiplied by this scale factor to be read correctly. $15 * 0.1 = 1.5$. When writing the value should be divided by the scale before being written. $1.5 / 0.1 = 15$.

Store

- **Yes:** Setting is stored in non-volatile memory, will remain across power cycles.
- **No:** Setting is not store in non-volatile memory. Generally has no need to be save.

Supported Function Codes

The EMX supports the following functions of the Modbus Application Protocol Specification, v1.1b3.

0x03 Read Holding Registers

0x04 Read Input Register

0x06 Write Single Register

0x10 Write Multiple Registers

NOTE

- The device address defaults to 247 (0xF7).
- Refer to the Modbus standard for CRC/LRC calculation procedures.

Parameters

Setup registers and parameters are available in 8 groups in the settings menu using the display or they may also be accessed using Modbus communications.

Settings

Settings are available in the following groups on the display (EMX and EMX-IP only) or SenvaSync App. A parameter list is provided in the following sections.

- **Metering** – Adjust metering parameters such as voltage and current scaling, phase sequencing, and display units.
- **Pulse Config** – Read the count of the two pulse inputs.
- **Communications** – See IPv4 and IPv6 values.
- **Alarms** - Enable or disable alarms and set trip points.
- **Real-Time Clock** – Set the date and time.
- **Logging** – Enable or disable logging as well as setting trigger source and what is logged.
- **Passcode** – Choose a passcode to lock device.
- **Advanced** – View firmware versions or initiate a factory reset.

The following sections detail how to adjust settings over the Modbus interface. All settings are stored in non-volatile memory. Stored values will not be lost if the meter experiences a power loss.

Metering

NOTE All registers in this section are readable/writable.

The Metering settings determine how the meters interpret the sensed current and voltage. They also configure the pulse outputs if available along with communications protocol settings.

NOTE Registers 2000 - 2005 apply to all three EMX models

Reg.	Description	Type	Min Max	Default	Scale Units
2000	Wiring Configuration	0 - 3Ph ABCN 1 - 3Ph ABC 2 - SinglePh ABN 3 - SinglePh AB 4 - SplitPh ABN	ENUM 0 3	0	-
2001	Current Element	0-Current Transformer 1-Rogowski Coil	ENUM 0 1	0	-

Reg.	Description		Type	Min Max	Default	Scale Units
2002	Current Scale Factor	1.0 - 6000.0 (Arms)	U16	10 60000	10	0.1 Amps per 0.333 Volts
2003	Current Orientation	0- +++ 1- ++- 2- +-+ 3- +-- 4- -++ 5- -+- 6- --+ 7- --- ordering is ABC	ENUM	0 7	0	-
2004	Voltage Scale Factor	0.1 - 320.00 (V/V)	U16	1 32000	100	0.01 Unitless
2005	Display Units	0-IEC Units 1-IEEE Units	ENUM	0 1	1	-

- Current scale is the primary side current of a 0.333V CT. CTs with an output voltage exceeding 0.333V should not be used. For a CT ratio of 20A / 0.333 V this will be $20.0 \times 10 = 200$. If a Rogowski coil is installed this value will need to be calculated from the coils mV/1000A rating. Rogowski conversion is calculated by $(333.33 \text{ mV} / \text{XXXmV}) \times 1000\text{A} \times 10(\text{scale})$.
- Voltage scale is the PT ratio expressed as a decimal and multiplied by 100. A potential transformer of 25:10 would give a ratio of $25 / 10 = 2.5$, appropriately scaled it would be $2.5 \times 100 = 250$.

NOTE Registers 2006 - 2015 apply to EMX and EMX-L, but do **not** apply to EMX-IP.

Reg	Description		Type	Min Max	Default
2006	Pulse Out 1 Source	0-Import Wh 1-Export Wh 2-Import VARh 3-Export VARh 4-Mirror Input 1 5-Mirror Input 2 6-Alarm Normally Open 7-Alarm Normally Closed 8-Phase Loss Normally Open 9-Phase Loss Normally Closed	ENUM	0 9	0

Reg	Description		Type	Min Max	Default
2007	Pulse Out 1 Wh per pulse	0-1 1-10 2-100 3-1000 4-10000	ENUM	0 4	3
2008	Pulse Out 1 duration	0-10ms 1-25ms 2-50ms 3-100ms 4-250ms 5-500ms	ENUM	0 5	0
2009	Pulse Out 2 Source	0-Import Wh 1-Export Wh 2-Import VARh 3-Export VARh 4-Mirror Input 1 5-Mirror Input 2 6-Alarm Normally Open 7-Alarm Normally Closed 8-Phase Loss Normally Open 9-Phase Loss Normally Closed	ENUM	0 7	0
2010	Pulse Out 2 Wh per pulse	0-1 1-10 2-100 3-1000 4-10000	ENUM	0 4	3
2011	Pulse Out 2 duration	0-10ms 1-25ms 2-50ms 3-100ms 4-250ms 5-500ms	ENUM	0 5	0
2012	Communications Protocol	0-Modbus 1-Bacnet	ENUM	0 1	0
2013	Communications Baud Rate	0-9600 1-19200 2-38400 3-57600 4-76800 5-115200	ENUM	0 5	1

Reg	Description		Type	Min Max	Default
2014	Communications Parity & Stop	0-Even parity 1 stop bit 1-Odd parity 1 stop 2-No parity 2 stop bits 3-No parity 1 stop bit	ENUM	0 3	0
2015	Communications Modbus Address	Modbus device address	U16	1 247	247

Alarms

Alarms can be enable and disabled as desired to trigger alarms if readings are outside the set ranges. Alarms will not interfere with the function of the meter, they are solely used to notify the user if there is an event that needs to be investigated.

Reg.	Description		Type	Min Max	Default	Scale Units
2016	Alarm Voltage Out of Range Enable	0-Disable 1-Enable	ENUM	0 1	0	-
2017	Alarm Voltage Out of Range Nominal	Nominal voltage, least significant digit is 1/10th of a Volt.	U16	10 60000	2400	0.1 Volts
2018	Alarm Voltage Out of Range Threshold	% Above nominal which will cause a fault.	U16	1 20	10	1 %
2019	Alarm Current Out of Range Enable	0-Disable 1-Enable	ENUM	0 1	0	-
2020	Alarm Current Out of Range Nominal	Nominal current, least significant digit is 1/10th of an Amp	U16	10 60000	50	0.1 Amps
2021	Alarm Current Out of Range Threshold	% Above nominal which will cause a fault.	U16	1 20	10	1 %
2022	Alarm Ground Current Out of Range Enable	0-Disable 1-Enable	ENUM	0 1	0	-
2023	Alarm Ground Current Out of Range Nominal	Nominal ground current, least significant digit is 1/10th of an Amp	U16	10 60000	50	0.1 Amps
2024	Alarm Ground Current Out of Range Threshold	% Above nominal which will cause a fault.	U16	1 20	10	1 %
2025	Alarm Frequency Out of Range Enable	0-Disable 1-Enable	ENUM	0 1	1	-
2026	Alarm Frequency Out of Range Nominal	Nominal frequency, least significant digit is 1/100th of a Hertz	U16	450 650	600	0.1 Hz
2027	Alarm Frequency Out of Range Threshold	% Above or below nominal which will cause a fault.	U16	1 20	10	1 %
2028	Alarm Voltage Phase Loss Enable	0-Disable 1-Enable	ENUM	0 1	1	-

Reg.	Description		Type	Min Max	Default	Scale Units
2029	Alarm Voltage Phase Loss Threshold	% Above or below nominal which will cause a fault.	U16	1 20	10	1 %
2030	Alarm Voltage Phase Imbalance Enable	0-Disable 1-Enable	ENUM	0 1	1	-
2031	Alarm Voltage Phase Imbalance Threshold	% Above or below nominal which will cause a fault.	U16	1 20	10	1 %
2032	Alarm Power Factor Low Enable	0-Disable 1-Enable	ENUM	0 1	1	1
2033	Alarm Power Factor Low Threshold	Unitless PF, below which alarm should trigger.	U16	1 99	50	0.01 Unitless

Advanced

Advanced settings are used to reset values and check firmware.

NOTE

- Register 2044 is reserved/unavailable for all models.

Reg.	Description		R/W	Type	Min Max	Default
2034	Reset Energy	Will reset all of the stored Wh, VAh and VARh values.	R/W	U16	0 1	0
2035	Count of Energy Resets	Count of the number of times the Wh reset field has been triggered.	R	U16	0 65535	0
2036	Reset Load Time	Will reset the run time counter, but not the system time counter.	R/W	U16	0 1	0
2037	Count of Load Time Resets	Count of the number of times the run time reset field has been triggered.	R	U16	0 65535	0
2038	Reset Pulse Counts	Will reset the pulse input counters.	R/W	U16	0 1	0
2039	Firmware Version Major	Firmware version major.minor.patch	R	U16	0 65535	0
2040	Firmware Version Minor	Firmware version major.minor.patch	R	U16	0 65535	0
2041	Firmware Version Patch	Firmware version major.minor.patch	R	U16	0 65535	0
2042	Reboot System	ESP will reboot both the MSP and ESP processors	R/W	U8	0 1	0
2043	Reset Log Content	Will reset all of the stored log entries. This will break communications for approx 25 seconds.	R/W	U16	0 1	0
2044	reserved	reserved	R/W	U16	0 0	0
2045	Set display passcode		R/W	U16	0 9999	0

Metering Registers (Preferred)

NOTE

- This section applies to all models of the EMX product line.
- The following table describes each of the power and energy readings provided over Modbus from the device.
- All registers in the table are **Read Only**.
- Store Values marked “yes” will be stored in non-volatile memory. Stored values will not be lost if the meter experiences a power loss.

Reg.	Description	Type	Min Max	Scale Units	Store
8001	V-LN Average	U32	0 4294967295	0.01 V(rms)	No
8002					
8003	V-LL Average	U32	0 4294967295	0.01 V(rms)	No
8004					
8005	Current Average	U32	0 4294967295	0.001 A(rms)	No
8006					
8007	Current Sum	U32	0 4294967295	0.001 A(rms)	No
8008					
8009	Real power total	I64	0 65535	0.00000001 W	No
8010					
8011					
8012					
8013	Reactive power total	I64	0 65535	0.00000001 VAR	No
8014					
8015					
8016					
8017	Apparent power total	I64	0 65535	0.00000001 VA	No
8018					
8019					
8020					

Reg.	Description	Type	Min Max	Scale Units	Store
8021	Real energy total	U64	0 65535	0.00000001 Wh	Yes
8022					
8023					
8024					
8025	Reactive energy total	U64	0 65535	0.00000001 VARh	Yes
8026					
8027					
8028					
8029	Apparent energy total	U64	0 65535	0.00000001 VAh	Yes
8030					
8031					
8032					
8033	V-LN Phase A	U32	0 4294967295	0.01 V(rms)	No
8034					
8035	V-LN Phase B	U32	0 4294967295	0.01 V(rms)	No
8036					
8037	V-LN Phase C	U32	0 4294967295	0.01 V(rms)	No
8038					
8039	V-LL Phase A-B	U32	0 4294967295	0.01 V(rms)	No
8040					
8041	V-LL Phase B-C	U32	0 4294967295	0.01 V(rms)	No
8042					
8043	V-LL Phase C-A	U32	0 4294967295	0.01 V(rms)	No
8044					
8045	Current Phase A	U32	0 4294967295	0.001 A(rms)	No
8046					
8047	Current Phase B	U32	0 4294967295	0.001 A(rms)	No
8048					

Reg.	Description	Type	Min Max	Scale Units	Store
8049	Current Phase C	U32	0 4294967295	0.001 A(rms)	No
8050					
8051	Power Factor Phase A	I16	-10000 10000	0.0001 Unitless	No
8052	Power Factor Phase B	I16	-10000 10000	0.0001 Unitless	No
8053	Power Factor Phase C	I16	-10000 10000	0.0001 Unitless	No
8054	Frequency (Phase A)	U16	0 65535	0.01 Hz	No
8055	Real power Phase A	I64	0 65535	0.00000001 W	No
8056					
8057					
8058					
8059	Real power Phase B	I64	0 65535	0.00000001 W	No
8060					
8061					
8062					
8063	Real power Phase C	I64	0 65535	0.00000001 W	No
8064					
8065					
8066					
8067	Reactive power Phase A	I64	0 65535	0.00000001 VAR	No
8068					
8069					
8070					
8071	Reactive power Phase B	I64	0 65535	0.00000001 VAR	No
8072					
8073					
8074					

Reg.	Description	Type	Min Max	Scale Units	Store
8075	Reactive power Phase C	I64	0 65535	0.00000001 VAR	No
8076					
8077					
8078					
8079	Apparent power Phase A	I64	0 65535	0.00000001 VA	No
8080					
8081					
8082					
8083	Apparent power Phase B	I64	0 65535	0.00000001 VA	No
8084					
8085					
8086					
8087	Apparent power Phase C	I64	0 65535	0.00000001 VA	No
8088					
8089					
8090					
8091	Real energy Phase A	I64	0 65535	0.00000001 Wh	Yes
8092					
8093					
8094					
8095	Real energy Phase B	I64	0 65535	0.00000001 Wh	Yes
8096					
8097					
8098					
8099	Real energy Phase C	I64	0 65535	0.00000001 Wh	Yes
8100					
8101					
8102					

Reg.	Description	Type	Min Max	Scale Units	Store
8103	Reactive energy Phase A	I64	0 65535	0.00000001 VARh	Yes
8104					
8105					
8106					
8107	Reactive energy Phase B	I64	0 65535	0.00000001 VARh	Yes
8108					
8109					
8110					
8111	Reactive energy Phase C	I64	0 65535	0.00000001 VARh	Yes
8112					
8113					
8114					
8115	Apparent energy Phase A	I64	0 65535	0.00000001 VAh	Yes
8116					
8117					
8118					
8119	Apparent energy Phase B	I64	0 65535	0.00000001 VAh	Yes
8120					
8121					
8122					
8123	Apparent energy Phase C	I64	0 65535	0.00000001 VAh	Yes
8124					
8125					
8126					
8127	Alarm Status Bitfield	U16	0 65525	1	No
8128	Load Status	ENUM	0 1	1	No

Reg.	Description	Type	Min Max	Scale Units	Store
8129	System power on time	U32	0	1	Yes
8130			4294967295		
8131	System load time	U32	0	1	Yes
8132			4294967295		
8133	Power reset count	U32	0	1	Yes
8134			4294967295		
8135	ADC error count	U32	0	1	No
8136			4294967295		
8137	Pulse Count 1	U32	0	1	Yes
8138			4294967295		
8139	Pulse Count 2	U32	0	1	Yes
8140			4294967295		

Metering Registers (Alternate)

NOTE

- This section applies to all models of the EMX product line.
- All registers in the table are **Read Only**.
- **Scale:** Values must be multiplied by this scale factor to be read correctly. For some power, current, and voltage readings, the scale factor will be automatically set based on the user settings for voltage and current scale. These multipliers can be read in registers 030-032.

Reg.	Description	Type	Min Max	Scale Units	Store
001	V-LN Average	U16	0 65535	V-scale V(rms)	No
002	V-LL Average	U16	0 65535	V-scale V(rms)	No
003	Current Average	U16	0 65535	I-scale A(rms)	No
004	Current Sum	U16	0 65535	I-scale A(rms)	No
005	Real power total	I16	-32768 32767	P-scale W	No
006	Reactive power total	I16	-32768 32767	P-scale VAR	No
007	Apparent power total	I16	-32768 32767	P-scale VA	No
008	V-LN Phase A	U16	0 65535	V-scale V(rms)	No
009	V-LN Phase B	U16	0 65535	V-scale V(rms)	No
010	V-LN Phase C	U16	0 65535	V-scale V(rms)	No
011	V-LL Phase A-B	U16	0 65535	V-scale V(rms)	No
012	V-LL Phase B-C	U16	0 65535	V-scale V(rms)	No
013	V-LL Phase C-A	U16	0 65535	V-scale V(rms)	No

Reg.	Description	Type	Min Max	Scale Units	Store
014	Current Phase A	U16	0 65535	I-scale A(rms)	No
015	Current Phase B	U16	0 65535	I-scale A(rms)	No
016	Current Phase C	U16	0 65535	I-scale A(rms)	No
017	Power Factor Phase A	I16	-1000 1000	0.0001 Unitless	No
018	Power Factor Phase B	I16	-1000 1000	0.0001 Unitless	No
019	Power Factor Phase C	I16	-1000 1000	0.0001 Unitless	No
020	Frequency (Phase A)	U16	480 620	0.1 Hz	No
021	Real power Phase A	I16	-32768 32767	P-scale W	No
022	Real power Phase B	I16	-32768 32767	P-scale W	No
023	Real power Phase C	I16	-32768 32767	P-scale W	No
024	Reactive power Phase A	I16	-32768 32767	P-scale VAR	No
025	Reactive power Phase B	I16	-32768 32767	P-scale VAR	No
026	Reactive power Phase C	I16	-32768 32767	P-scale VAR	No
027	Apparent power Phase A	I16	-32768 32767	P-scale VA	No
028	Apparent power Phase B	I16	-32768 32767	P-scale VA	No
029	Apparent power Phase C	I16	-32768 32767	P-scale VA	No

Reg.	Description		Type	Min Max	Scale Units	Store
030	Voltage Scale Factor (V-scale)	-4:0.0001 -3:0.001 -2:0.01 -1:0.1	I16	-2 2	1	No
031	Current Scale Factor (I-scale)	0:1 1:10 2:100 3:1000	I16	-3 1	1	No
032	Power Scale Factor (P-scale)	4:10000 5:100000 6:1000000	I16	-4 6	1	No
033	Alarm Status Bitfield	Bit 0: Pulse Config Bit 1: Pulse Overrun Bit 2: Voltage Range Bit 3: Current Range Bit 4: Neutral Current Bit 5: Frequency Range Bit 6: Vlt Phase Loss Bit 7: Vlt Ph Imbalance Bit 8: Low Power Factor Bit 9: Accumulator Loss Bit 10: RTC Error Bit 11: Logs Full Bit 12: Meter Settings	U16	0 0xFFFF	1	No
034	Load Status	0 - No load detected, 1 - Load current above threshold	ENUM	0 1	1	No
035	System power on time	Time in seconds that meter (MSP) has been powered on	U32	0 4294967295	1 Seconds	Yes
036						
037	System run time	Time in seconds that system has had a load detected	U32	0 4294967295	1 Seconds	Yes
038						
039	Power reset count	Number of times device power has been removed	U32	0 4294967295	1	Yes
040						
041	Pulse Count 1		U32	0 4294967295	1	Yes
042						
043	Pulse Count 2		U32	0 4294967295	1	Yes
044						

Reg.	Description	Type	Min Max	Scale Units	Store
045	Real Net Energy total	I64	-9.233e+18 9.233e+18	0.00000001 Wh	Yes
046					
047					
048					
049	Real Net Energy Phase A	I64	-9.233e+18 9.233e+18	0.00000001 Wh	Yes
050					
051					
052					
053	Real Net Energy Phase B	I64	-9.233e+18 9.233e+18	0.00000001 Wh	Yes
054					
055					
056					
057	Real Net Energy Phase C	I64	-9.233e+18 9.233e+18	0.00000001 Wh	Yes
058					
059					
060					
061	Reactive Net Energy total	I64	-9.233e+18 9.233e+18	0.00000001 VARh	Yes
062					
063					
064					
065	Reactive Net Energy Phase A	I64	-9.233e+18 9.233e+18	0.00000001 VARh	Yes
066					
067					
068					
069	Reactive Net Energy Phase B	I64	-9.233e+18 9.233e+18	0.00000001 VARh	Yes
070					
071					
072					

Reg.	Description	Type	Min Max	Scale Units	Store
073	Reactive Net Energy Phase C	I64	-9.233e+18 9.233e+18	0.00000001 VARh	Yes
074					
075					
076					
077	Apparent Net Energy total	I64	-9.233e+18 9.233e+18	0.00000001 VAh	Yes
078					
079					
080					
081	Apparent Net Energy Phase A	I64	-9.233e+18 9.233e+18	0.00000001 VAh	Yes
082					
083					
084					
085	Apparent Net Energy Phase B	I64	-9.233e+18 9.233e+18	0.00000001 VAh	Yes
086					
087					
088					
089	Apparent Net Energy Phase C	I64	-9.233e+18 9.233e+18	0.00000001 VAh	Yes
090					
091					
092					
093	Real Import Energy total	U64	0 18.446e+18	0.00000001 Wh	Yes
094					
095					
096					
097	Real Import Energy Phase A	U64	0 18.446e+18	0.00000001 Wh	Yes
098					
099					
100					

Reg.	Description	Type	Min Max	Scale Units	Store
101	Real Import Energy Phase B	U64	0 18.446e+18	0.00000001 Wh	Yes
102					
103					
104					
105	Real Import Energy Phase C	U64	0 18.446e+18	0.00000001 Wh	Yes
106					
107					
108					
109	Reactive Import Energy total	U64	0 18.446e+18	0.00000001 VARh	Yes
110					
111					
112					
113	Reactive Import Energy Phase A	U64	0 18.446e+18	0.00000001 VARh	Yes
114					
115					
116					
117	Reactive Import Energy Phase B	U64	0 18.446e+18	0.00000001 VARh	Yes
118					
119					
120					
121	Reactive Import Energy Phase C	U64	0 18.446e+18	0.00000001 VARh	Yes
122					
123					
124					
125	Apparent Import Energy total	U64	0 18.446e+18	0.00000001 VAh	Yes
126					
127					
128					

Reg.	Description	Type	Min Max	Scale Units	Store
129	Apparent Import Energy Phase A	U64	0 18.446e+18	0.00000001 VAh	Yes
130					
131					
132					
133	Apparent Import Energy Phase B	U64	0 18.446e+18	0.00000001 VAh	Yes
134					
135					
136					
137	Apparent Import Energy Phase C	U64	0 18.446e+18	0.00000001 VAh	Yes
138					
139					
140					
141	Real Export Energy total	U64	0 18.446e+18	0.00000001 Wh	Yes
142					
143					
144					
145	Real Export Energy Phase A	U64	0 18.446e+18	0.00000001 Wh	Yes
146					
147					
148					
149	Real Export Energy Phase B	U64	0 18.446e+18	0.00000001 Wh	Yes
150					
151					
152					
153	Real Export Energy Phase C	U64	0 18.446e+18	0.00000001 Wh	Yes
154					
155					
156					

Reg.	Description	Type	Min Max	Scale Units	Store
157	Reactive Export Energy total	U64	0 18.446e+18	0.00000001 VARh	Yes
158					
159					
160					
161	Reactive Export Energy Phase A	U64	0 18.446e+18	0.00000001 VARh	Yes
162					
163					
164					
165	Reactive Export Energy Phase B	U64	0 18.446e+18	0.00000001 VARh	Yes
166					
167					
168					
169	Reactive Export Energy Phase C	U64	0 18.446e+18	0.00000001 VARh	Yes
170					
171					
172					
173	Apparent Export Energy total	U64	0 18.446e+18	0.00000001 VAh	Yes
174					
175					
176					
177	Apparent Export Energy Phase A	U64	0 18.446e+18	0.00000001 VAh	Yes
178					
179					
180					
181	Apparent Export Energy Phase B	U64	0 18.446e+18	0.00000001 VAh	Yes
182					
183					
184					

Reg.	Description		Type	Min Max	Scale Units	Store
185	Apparent Export Energy Phase C		U64	0 18.446e+18	0.00000001 VAh	Yes
186						
187						
188						
189	Meter time since boot	Time in seconds since the meter (MSP) booted up	U32	0 4294967295	1 Seconds	Yes
190						

Real-Time Clock Registers

NOTE

- Available on the EMX and EMX-IP meters.
- Not available on the EMX-L meters.

Reg.	Description		R/W	Type	Min Max	Scale Units	Store
4000	RTC - Set Year		R/W	U16	2022 2060	1	No
4001	RTC - Set Month		R/W	U8	1 12	1	No
4002	RTC - Set Day of Month		R/W	U8	1 31	1	No
4003	RTC - Set Day of Week	0 = Sun. 6 = Sat.	R/W	ENUM	0 6	1	No
4004	RTC - Set Hours	24 hour format	R/W	U8	0 23	1 Hrs	No
4005	RTC - Set Minutes		R/W	U8	0 59	1 Mins	No
4006	RTC - Set Seconds		R/W	U8	0 59	1 Secs	No
4007	RTC - Commit time	Update real time-clock and store on PCF85263 RTC module	R/W	ENUM	0 1	1	Yes
4100	RTC - Current Year		R	U16	2022 2060	1	Yes
4101	RTC - Current Month		R	U8	1 12	1	Yes
4102	RTC - Current Day of Month		R	U8	1 31	1	Yes
4103	RTC - Current Day of Week	0 = Sun. 6 = Sat.	R	ENUM	0 6	1	Yes
4104	RTC - Current Hours	24-hour or 12-hour formats	R	U8	0 0	1 Hrs	Yes
4105	RTC - Current Minutes		R	U8	0 0	1 Mins	Yes
4106	RTC - Current Seconds		R	U8	0 0	1 Secs	Yes

Reg.	Description		R/W	Type	Min Max	Scale Units	Store
4107	RTC - Current AM/PM Flag, or 0	If in 24 hour mode, will return 0. If in 12 hour mode: 1 = AM, 2 = PM	R	ENUM	0 2	1	Yes

Logging Registers

NOTE

- Available on the EMX and EMX-IP meters.
- Not available on the EMX-L meters.

Log Source 1 through Log source 12 sets the source for the logging. Write the Modbus register 1-190 to the desired source to log that point. If a log source register has multiple registers all registers need to be set. For example, if Real Net Energy total is desired to be logged all four registers need to be set.

To trigger a log event register 5000 (Logging – Trigger Source) needs to be set to the desired trigger mode, by default it is set to be disabled. Logging can be triggered with the timer, set on Modbus point 5001 (Logging – Trigger Interval) in seconds from 15-3600. Triggering can be set over COMMS by writing a ‘1’ to point 5015 (Logging – Trigger log creation), or Pulse In 1 or 2 can be set to trigger a log whenever a pulse is detected.

Reg.	Description		R/W	Type	Min Max	Scale Units	Store
5000	Logging - Trigger Source	0 - Disabled 1 - Timer 2 - Comms 3 - Pulse In 1 4 - Pulse In 2	R/W	ENUM	0 4	1	Yes
5001	Logging - Trigger Interval		R/W	U16	15 3600	1 Secs	Yes
5002	Logging - Mode Select	0 - Continuous - continue logging and overwrite old entries, sequentially 1 - One Shot - log until EEPROM is full, then stop logging and throw alarm	R/W	ENUM	0 2	1	Yes
5003	Logging - Log Source 1		R/W	U16	1 190	1	Yes
5004	Logging - Log Source 2		R/W	U16	1 190	1	Yes
5005	Logging - Log Source 3		R/W	U16	1 190	1	Yes
5006	Logging - Log Source 4		R/W	U16	1 190	1	Yes
5007	Logging - Log Source 5		R/W	U16	1 190	1	Yes
5008	Logging - Log Source 6		R/W	U16	1 190	1	Yes

Reg.	Description	R/W	Type	Min Max	Scale Units	Store
5009	Logging - Log Source 7	R/W	U16	1 190	1	Yes
5010	Logging - Log Source 8	R/W	U16	1 190	1	Yes
5011	Logging - Log Source 9	R/W	U16	1 190	1	Yes
5012	Logging - Log Source 10	R/W	U16	1 190	1	Yes
5013	Logging - Log Source 11	R/W	U16	1 190	1	Yes
5014	Logging - Log Source 12	R/W	U16	1 190	1	Yes
5015	Logging - Trigger log creation	R/W	U16	0 1	1	Yes
5016	Logging - Read log at index	R/W	U16	1 4096	1	Yes
5100	Logging - Oldest Index	R	U16	0 4096	1	Yes
5101	Logging - Count of log entries	R	U16	0 4096	1	Yes
5102	Logging - Current Index	R	U16	0 4096	1	Yes
5103	Logging - Log data 1	R	U16	0 65535	1	Yes
5104	Logging - Log data 2	R	U16	0 65535	1	Yes
5105	Logging - Log data 3	R	U16	0 65535	1	Yes
5106	Logging - Log data 4	R	U16	0 65535	1	Yes
5107	Logging - Log data 5	R	U16	0 65535	1	Yes
5108	Logging - Log data 6	R	U16	0 65535	1	Yes

Reg.	Description	R/W	Type	Min Max	Scale Units	Store
5109	Logging - Log data 7	R	U16	0 65535	1	Yes
5110	Logging - Log data 8	R	U16	0 65535	1	Yes
5111	Logging - Log data 9	R	U16	0 65535	1	Yes
5112	Logging - Log data 10	R	U16	0 65535	1	Yes
5113	Logging - Log data 11	R	U16	0 65535	1	Yes
5114	Logging - Log data 12	R	U16	0 65535	1	Yes

Reg. EMX	Reg. EMX-IP	Description	R/W	Type	Min Max	Scale Units	Store
5115	5120	Logging - Log time stamp seconds	R	U16	0 59	1	Yes
5116	5119	Logging - Log time stamp minutes	R	U16	0 59	1	Yes
5117	5118	Logging - Log time stamp hours	R	U16	0 23	1	Yes
5118	5117	Logging - Log time stamp day of month	R	U16	0 31	1	Yes
5119	5116	Logging - Log time stamp month	R	U16	0 12	1	Yes
5120	5115	Logging - Log time stamp year	R	U16	23 256	1	Yes
5121	5121	Logging - CRC	R	U16	0 65535	1	Yes

Appendix A: MODBUS Exception Codes

Modbus Exception Codes		
Code	Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the server (or slave). This may be because the function code is only applicable to newer devices and was not implemented in the unit selected. It could also indicate that the server (or slave) is in the wrong state to process a request of this type, for example because it is unconfigured and is being asked to return register values.
02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the server (or slave). More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, the PDU addresses the first register as 0, and the last one as 99. If a request is submitted with a starting register address of 96 and a quantity of registers of 4, then this request will successfully operate (address-wise at least) on registers 96, 97, 98, 99. If a request is submitted with a starting register address of 96 and a quantity of registers of 5, then this request will fail with Exception Code 0x02 "Illegal Data Address" since it attempts to operate on registers 96, 97, 98, 99 and 100, and there is no register with address 100.
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for server (or slave). This indicates a fault in the structure of the remainder of a complex request, such as that the implied length is incorrect. It specifically does NOT mean that a data item submitted for storage in a register has a value outside the expectation of the application program, since the MODBUS protocol is unaware of the significance of any particular value of any particular register.